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ABSTRACT

A teacher in a small Christian school noticed that many of her third grade students found the A Beka spelling drill rather tedious. Many Christian schools use the A Beka spelling curriculum with lessons based upon special phonetic sounds. The students are introduced to alphabetical order and dictionary skills. These skills seem appropriate and necessary for good spelling instruction. The classroom had several Apple IIe computers with "Spellevator" software. A study was conducted to see if the drill on the computer would work as well or better than the paper and pencil spelling drill. The computer provided immediate feedback on whether or not a word was spelled correctly. Students moved up levels in the program based on their knowledge of spelling words as well as the definitions to these words. Since the class was very small, a quasi-experimental approach was used. All the students participated in both kinds of spelling drill. The study lasted eight weeks. The students received four weeks of instruction alternating weeks in each kind of drill. The first week was the paper and pencil drill. The second week was computer drill. Students were given a posttest each Friday. The scores for the computer drill were compared to the scores of the paper and pencil drill using a t-test. The mean score for the computer drill was slightly higher than that of the paper and pencil drill. However, no significant difference was found. When the students were asked to vote on the kind of drill they preferred, all voted to practice with the computer. Findings determined that computer drill can work at least as well as paper and pencil drill. (Contains 23 references.) (Author/RS)

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ED 441 253

A COMPARISON OF SPELLING DRILL AND PRACTICE: COMPUTER VERSUS PAPER AND PENCIL ACTIVITIES

A Research Project
Presented to
The Department of Teacher Education
of Johnson Bible College

In Partial Fulfillment
Of the Requirement for the Degree
Master of Arts in
Educational Technology and Bible

By
Diane Lind Darling
March 9, 2000

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APPROVAL PAGE

This Action research project by Diane Lind Darling is accepted in its present form by the Department of Teacher Education at Johnson Bible college as satisfying the action research project requirements for the degree Master of Arts in Educational Technology and Bible.

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Since the class was very small, a quasi-experimental approach was used. All the students participated in both kinds of spelling drill. The study lasted eight weeks. The students received four weeks of instruction alternating weeks in each kind of drill. The first week was the paper and pencil drill. The second week was computer drill. Students were given a posttest each Friday. The scores for the computer drill were compared to the scores of the paper and pencil drill using a t-test. The mean score for the computer drill was slightly higher than that of the paper and pencil drill. However, no significant difference was found. When the students were asked to vote on the kind of drill they preferred, all voted to practice with the computer. We have determined that computer drill can work at least as well as paper and pencil drill.

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Chapter 1

INTRODUCTION

Significance of the Problem

Many students in Christian schools are receiving their spelling instruction utilizing the A Beka Spelling Curriculum. The lessons are based upon special phonetic sounds. The students are also introduced to alphabetical order and dictionary skills. These skills are introduced and reinforced by crossword puzzles, finding the missing sounds, and looking for suffixes or prefixes. The spelling lists for each week contain content words and vocabulary words. The students are also expected to use the words in the writing of sentences and stories. Many of the students find the drill work tedious and need encouragement to complete the assignments.

Since the computer is a tool that is often viewed as fun, a computer program that provides a variety of practice activities over the same skills might produce better results in students' mastery of each spelling list. There are several computer programs that might accomplish such a task. Two programs that will permit the teacher to enter a list of spelling words are "Spellevator" and "Spelling Workout" from MECC (Minnesota Educational Computing Corporation). The computer might provide drill and practice in a more visual, and interesting format than the workbook style format used in the A Beka curriculum. If the students complete the practice on the computer, then perhaps they will perform better on weekly tests of these words.

Statement of the Problem

Many Christian schools use the A Beka curriculum, a curriculum that uses a phonetic approach to the instruction of Spelling. This program provides drill and practice in a workbook. A computer could provide similar drill and practice using pictures and sounds in a game format on a computer. This study will determine whether the computer drill and practice produces a significant gain in spelling achievement over the traditional workbook practice when measured by weekly spelling tests.

Definition of Terms

Computer assisted instruction In this study computer assisted instruction (CAI) is instruction given via computer and can be exhibited in four common modes: drill and practice, simulation, tutorial, and games.

Conventional drill and practice Conventional means any drill and practice using textbook activities found in the student workbook; looking up words in a dictionary; writing the words on hand writing paper; or using the words in a sentence. Conventional also includes written word games such as crossword puzzles, or word searches.

A Beka Spelling Curriculum for Third Grade This curriculum was initially copyrighted in 1989 and again in 1997 by Pensacola Christian College located in Pensacola, Florida 32523-9160. It is widely used and accepted among Christian schools in Melbourne, Florida.

> It is a well-planned book that guides students toward better spelling, a richer vocabulary, and an enjoyment of good poetry. The book contains weekly spelling lists, activities related to the spelling lists, a glossary of vocabulary words, and selected poetry. (Ashbaugh, p. T3)

Content Words Content words include words that are commonly used. Each lesson contains five content words. "Content words include terms from academic areas, words from everyday life, or words that are used frequently" (Ashbaugh, p. T3). The content words are words 21-25 in each weeks lesson.

Vocabulary Words New to Students Three words in each lesson are included to increase a child's vocabulary. " These words may be from their readers, other school subjects, or everyday life. Students need to learn the spelling and definition of each word, and the spelling of each word in the definition." (Ashbaugh, p. T11) The Vocabulary Words are words 26-28 in each weeks lesson. For this research project only the spelling of the words listed in each lesson was included.

Weekly Spelling Test A test is provided with the A Beka Spelling Curriculum for each word list. These tests are administered by the classroom teacher who pronounces the word, reads it in a sentence, and then pronounces the word again. The students write the word after the teacher reads it orally.

Phonetic Of or pertaining to speech sounds, their production, or their transcription in written symbols. (Stein, p. 998)

Phonics A method of teaching reading, pronunciation, and spelling based upon the phonetic interpretation of ordinary spelling. (Stein, p. 998)

Spellevator This software uses the computer's capabilities to motivate students to practice their classroom spelling words. As students play this

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imaginative arcade-style game, they spell their words and receive immediate feedback to their responses. (Spellevator Manual, p.3)

Limitations of the Study

Certain limitations of this study need to be considered including the following:

1. This study will be done in a self-contained, private, Christian third grade classroom. There are only nine children in the class, who are taught in the mornings by the researcher and in the afternoons by another teacher.
2. No attempt was made to find the best curriculum to use in conjunction with computer assisted instruction.
3. The computers available for the students are rather dated Apple IIe computers. Current research on computer assisted instruction would utilize the capabilities of a Macintosh or Windows program that would have the benefit of more memory, better graphics, and sound capabilities that are not available on an Apple IIe.
4. The software was selected on the basis of availability and ease of adaptation to the A Beka spelling lists.

Assumptions

For this study a number of assumptions were considered necessary:

1. The A Beka Curriculum which is a structured phonetic approach to spelling is accepted as an educationally sound method of teaching spelling.
2. The use of dated computers and software will not affect the intended outcome of student achievement in spelling.

3. All students have had equivalent previous experience with microcomputers during school hours.

The Null Hypothesis

There will be no significant difference at the .05 level in student achievement of those that experienced computer assisted instruction and those that experienced conventional drill and practice as measured by the A Beka spelling tests.

Chapter 2

REVIEW OF RELATED LITERATURE

History of Computer Assisted Instruction in Education

During the late 1950s and early 1960s preliminary experiments in computer-assisted instruction began in the United States. The funding for these experiments came from private foundations, major computer vendors, or federal agencies such as the National Science Foundation. The projects were conducted in several major universities, among these were Dartmouth, Stanford, and the University of Illinois. During this period many educators had high expectations of CAI and predicted that CAI would change the entire structure of education. (Chambers & Sprecher, p.6).

The Dartmouth project developed a simplified way to program a computer. This programming language was known as BASIC. This language was then used to develop many CAI programs for use in the public schools (Chambers & Sprecher, p.6). These computer lessons had been used in conjunction with the regular classroom assignments but were not used as total courses in any subject.

Suppes (Suppes & Morningstar, pp. 343-345) developed one of the earliest drill-and-practice programs for elementary students. The main purpose of the program was to provide drill and practice in arithmetic skills as a supplement to regular classroom instruction. The Stanford Achievement Test was administered to both experimental and control classes. The results indicated significant increases in the performance level of those students using the computer.

As early as 1960 research began at the Coordinated Science Laboratory of the University of Illinois. The purpose of this research was to explore the possibilities of computers in individual instruction. The result of the research led to a teaching system called PLATO. The Control Data Corporation acquired the rights to the PLATO system and marketed CDC PLATO all over the world (Lyman, p.5). The PLATO materials were used and evaluated in five community colleges. The results of this research indicated that a large number of students developed positive attitudes toward the materials, but no significant achievement effects were found (Chambers & Sprecher, p.9).

Although this early research has not changed the entire structure of education, it has provided valuable information for the classroom. The research done at Dartmouth, Stanford, and the University of Illinois all indicated positive results in the area of computer assisted instruction. None of these projects were designed to eliminate the role of teachers or instruction, but to be used in addition to the classroom instruction. The Dartmouth project found the computer helpful in problem solving; the project by Suppes found the computer helpful for repetitive tasks such as drill-and-practice; and the PLATO project utilized the computer for individualizing instruction.

Achievement Gains Utilizing Computer Assisted Spelling

Several studies indicate that Computer Assisted Instruction would positively benefit students in learning to spell. One of the earliest studies was financed by a grant from the National Science Foundation and sought to incorporate cognitive theory of spelling with microcomputer instruction (Block, p. 3). In theory, students use stored information about phoneme to grapheme correspondences to generate a plausible spelling

for a word. "This theory is qualitatively different from those of Thorndike's era because it is based on the constructs of cognitive psychology and applied to spelling and learning" (Block, p. 19). The programs developed for the study only ran on Datapoint cathode-ray-tube terminals, but it is worth mentioning because some programs for Computer Assisted Spelling Instruction were developed with a foundation in cognitive theory.

As early as 1982, CAI was evaluated for its effectiveness in the teaching of reading, vocabulary, and language. One study reviewed sixteen research projects and found that CAI was not only effective in the teaching of reading, but that in some cases was more effective than traditional methods at that time (Caster, p. 1). The capability of using CAI in the teaching of spelling and writing resulted in mixed results (Caster, p. 23). No plausible reason for this inconsistency of research findings was given. It should be noted that some of the studies reviewed added CAI to traditional instruction, which gave the CAI group more time on task. The CAI group would have an advantage by spending more time on spelling than the traditional group. One would expect groups receiving more practice time to perform better than groups that did not receive the additional practice.

Texas Instruments produced a product called "Speak and Spell." The Texas Instruments 99/4 Personal Computer kept a record of the student's progress and could hold a list of 792 words. When a student signed on, a list of words was selected based on that student's previous spelling performance. The computer individualized the lessons for each student. This program was compared to more conventional instruction by using an analysis of variance. The results indicated that there was greater effectiveness with

the computer program (Thomas & Gustafson, p. 168). A secondary study dealt with the issue of how many words per lesson should be taught. One group was given 20 words in each lesson and the other group was given 30 words. The number of words per session did not produce a significant difference on achievement for the 44 third and fourth grade students in this study (Thomas & Gustafson, p. 172).

Another study compared the achievement scores for students receiving traditional spelling instruction to achievement scores earned with computer aided instruction. The subjects were fourth and fifth grade pupils who were measured by using a traditional end of the week spelling test. The attitudes of students were also measured by using a semantic differential at the beginning and end of the computer-aided segment of the study. The student achievement improved with computer aided instruction while the attitudes did not change (Gore, & others p. 1).

Most of the research between 1976 through 1989 reported significant differences in spelling achievement when compared to traditional instruction. Pupils who received a computer word study program showed significant gains in recognizing misspelled words on a standardized spelling test ($p<.001$) (Weber & Henderson, p 167). Since standardized testing holds value in our society and much of it requires a student to recognize the misspelled word, the computer is an excellent tool for generating such practice. All students were able to achieve with the computer word study program.

Since this time there has been a shift in both computer technology and funding for studies in CAI. While the hardware capabilities of computers seems to be improving all the time, research on CAI and its effect on learning seems to have slowed considerably in

the last decade. More research needs to be done in this area. Software development is inevitability behind that of hardware, but there seems to be a lag in utilizing hardware developments to design software with innovative and improved educational capabilities.

Computer Assisted Spelling with Low-Achieving Students

Computers have been used with students who were having difficulty with spelling and positive outcomes were achieved. In one study underachieving elementary students were given instruction utilizing two spelling programs. The effectiveness of these programs was measured by the traditional weekly spelling tests. Students learned the programs, and data were collected over an entire school year. Both programs generated higher accuracy in spelling than did the traditional procedures (McAuley & McLaughlin, p. 362). Only one of these programs utilized the computer. The other utilized a method called Add-A-Word. The Add-A-Word method consisted of first studying the word, covering it, copying the word, writing it, and then comparing it for accuracy against the original word list. This method was also superior to the traditional classroom instruction. There was only a slight difference between the Add-A-Word method and the computer Compu Spell program, but both of these were superior to traditional instruction. The Compu Spell program was under the direction of the special education teacher and took place in the computer room. It was slightly better than the Add-A-Word method. Since there were only five subjects in the study of the poorest spellers in a third grade class, perhaps more of a difference would be noted if more subjects were involved in the study.

Another study involving spelling practice for children with learning disabilities resulted in positive results. Nine-year Old Dutch children with language disorders were

allowed to copy spelling words from a computer screen. Significantly fewer spelling errors were made on the post-test than writing words from memory. Both these forms of practice led to fewer spelling errors than only reading the words (van Daal & van der Leij, p. 186). It would appear that computer assisted instruction would enhance spelling achievement of low-achieving students as well as those randomly selected from a class of equally distributed students.

Another study compared the effectiveness of CAI, traditional instruction, and no practice on the mastery of spelling words for students with attentional difficulties. This study found that both CAI and traditional instruction were significantly more effective than no practice. The comparison between CAI and traditional instruction showed no significant difference for students with ADD (Fitzgerald, et. al., p.376-79). The design included a spelling pre-test on the first day, either CAI or Traditional Instruction in the form of structured drills on the next three days with a post-test on day five. The students were given 25 words each week. The words were sorted between CAI instruction and teacher instruction. The CAI software utilized for this study was "Spelling Machine" (Fitzgerald, et. al. p. 377). The study also had a small number of subjects. It only included ten students who were identified as distractible in their learning habits, and of the 10, only 9 were rated to qualify for the study based on the rating scale used to judge Inattention/Overactivity (Fitzgerald et. al. p. 377). Perhaps a larger sample size would have produced more significant results.

A study on computer-based spelling remediation for dyslexic children found that multimedia presentation techniques using synthesized speech was helpful in presentation

because it avoided reliance on textual presentation. The integration of both vision and sound provided positive results (Fawcett, et. al. p. 183). The newer computers are able to use speech as well as text to present new information.

There appears to be a slight contradiction in the review of the literature. Some studies show significant differences in average to above average students, and others report little or no difference at all primarily with a small number of students who have been identified as having some kind of learning disability. Perhaps the variety of software or the use of the computer instruction might contribute to the discrepancy in research findings. Perhaps students with learning disabilities need a different kind of software than average to above average students. All the reported CAI instruction did help students learn to spell, and all had a positive effect on student achievement.

Computer Assisted Instruction and Student Motivation

The computer can do things that cannot be done by the teacher. The computer never gets tired, busy, or distracted. It will give immediate feedback to all student responses without fail. One would think that the animated graphics and positive responses would be highly motivating for students. The research in this area does not bear that out. An experiment was conducted to test if graphics used in the feedback portion of a spelling drill program increased motivation when compared with an otherwise identical program without graphic feedback. The subjects were fourth and fifth grade students. The results showed that graphic feedback was not effective at maintaining interest in the use of computer for studying spelling lists (Surber, p. 16). While students report that they like CAI and that the graphics are fun, these things do not significantly

change student attitudes toward spelling instruction. When students were measured via pre-test and post-test scores on a semantic differential instrument, their attitudes were not significantly changed (Gore et. al. p 15). While many students and teachers continue to report positive views about CAI, research data does not support the use of computer graphics as significantly motivational.

It would appear that one of the best uses of the computer is as a tool for practicing a skill already learned or utilizing the computer as a tool for creative expression. The Keyboarding, Reading, and Spelling (KRS) method incorporates both instruction in reading and language skills with computer-assisted instruction. This program called the (KRS) program was developed to teach reading and language skills to elementary school students by integrating computer assisted-instruction with an instructional method. In other words the computer was used in addition to classroom teacher instruction. Classes from two schools in the Murray City schools were randomly assigned to either the treatment or comparison group. The program was taught for a period of four months. At the end of the study the (KRS) group achieved more than the comparison group in all areas. The (KRS) group made significant gains in keyboarding and computer operation skills (Reid, p. 1-14). It appears that the use of a computer can have a positive effect on student achievement if it is used as a tool to enhance the traditional classroom instruction.

Software and Cognitive Processing

While CAI seems to be highly effective in the area of student achievement, there seems to be at least two differing viewpoints on the design of computer software. One

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study compared two different programs. One was designed offering a predominantly cognitivist-phonological learning paradigm, and the other was predominantly behaviorist-visual learning paradigm of the type employed by many commercial spelling programs. Spelling research seems to suggest the desirability of teaching learners to spell using a cognitivist paradigm with greater emphasis on phonological strategies (Cates & Goodling, p. 29). The results of the study showed no significant difference between the two computer groups. Both of these paradigms showed significant gains in spelling achievement.

Since computer assisted instruction was not designed or intended as the only instructional tool for any discipline, it might be prudent to measure the effectiveness of computer-assisted instruction as an addition to classroom instruction and compare it only to the drill and practice portion of the lesson. An example of this type of study could be a comparison between drill and practice on a computer and traditional paper and pencil practice. The computer has the capability for giving immediate feedback to the child on whether his or her answer was correct or incorrect. Traditionally students who complete independent practice must wait until their papers are graded to determine whether or not they have mastered a skill. Sometimes students have practiced the skill incorrectly several times before the teacher has the opportunity to correct the child's error. Since the computer can offer immediate feedback to the child, the practice could be based on the child's needs. Practice could be individualized according to the words the child spelled incorrectly.

More research is needed to find out what software is effective with third grade students and whether the immediate feedback provided by the computer has any effect on spelling achievement. In addition more research with the software and computers already existing in classrooms should be conducted. The last decade has been a race to get the equipment into the schools. Most classrooms have at least one computer. Now what is an effective use of the available equipment? The available equipment may not be the state of the art equipment, but rather an effective use of older equipment and available software. Can Apple IIe computers with spelling programs on floppy disks still produce positive results in spelling achievement.

Chapter 3

METHODS AND PROCEDURES

Quasi-Experimental Design

The study will involve only nine subjects. The subjects will be given eight lessons from the A Beka third grade-spelling curriculum. Four of the lessons will be using a computer for all the drill and practice, and four of the lessons will use the workbook and paper and pencil drill and practice. The subjects will complete one lesson each week for a total of eight weeks. Since the lessons progress in difficulty, the methods will be alternating every other week. The first will follow the workbook, paper and pencil method, and the second week will follow the computer method. This pattern of alternating weeks will continue until all eight weeks of the study have been completed.

Subjects

The subjects were not randomly selected. They compose the whole third grade class of a Christian school in Central Florida. The parents pay tuition for the students to attend this school, but the tuition is moderate for the area. The subjects appear to come from middle class families who are interested in their children's education. The third grade class was selected because the researcher happens to teach this group of children each morning. No effort was made to choose the subjects based on spelling or computer ability. All of the students in the class attended the same school last year. These subjects were exposed to the computer and in addition have had some keyboarding practice. Several of the students also have computers in their homes, but no student has

the Spelling programs used in this study at their home. The computer access for spelling using "Spellevator" and "Spelling Workout" will be limited to the class time of 30 minutes.

Pretests and Posttests

The subjects will be given a pretest to determine the spelling words that each child will need to work on for the week. If a child already knows how to spell a word, the drill and practice activities will not be centered on those words. All words will be included in the posttest each week. All words will be used in some of the drill and practice activities, but will focus on the words that each child has the most difficulty spelling. Each lesson has twenty-eight spelling words that will be included in a posttest. Twenty-eight words are included on each list that comes with the A Beka Curriculum. The number of words included in a lesson made no difference in spelling achievement when the number varied between twenty and thirty words (Thomas and Gustafson p. 172). The posttest scores for each method will be compared to see if there is any significance difference in drill and practice methodology. There will be a total of 40 scores using the computer method for drill and practice and a total of 40 scores for the paper and pencil drill and practice method.

Statistics

Four weeks of posttest scores for subjects receiving the workbook, paper and pencil method will be compared to four weeks of posttest scores for subjects receiving the computer method. These scores will be compared using a t-test. Since the same subjects are given alternating treatments no comparison of pretest scores is necessary.

The treatment groups are the same children. The only variable in this study is the methodology used for drill and practice.

Conventional Method

The subjects will complete four lessons of spelling drill and practice using the A Beka third grade Spelling and Poetry book which is the third grade textbook for this curriculum. It is a paperback workbook with activities to help students learn a list of spelling words. Lessons 3,5,7,and 9 will follow the workbook activities. Lesson 3 focuses on words that use the following phonetic sounds: ck in duck, e in me, o in go, y in fly, and ay in pray. Lessons 4-6 focus on the phonetic sounds of st in stop, pl in plane, fr in frog, and tr in train. Lessons 6-7 focus on the phonetic sounds of sh in ship bl in block and th in thick, and th in this. Lessons 8-9 focus on the phonetic sounds of cl in clock, fl in flake, and gl in glue. The students will also write the list of words one time each and use the words in writing sentences. In addition the students will look up five words from the list in the dictionary each day. The students will be limited to thirty minutes of Spelling practice per day. If the workbook items are not completed within the thirty minutes of class time no additional time will be given for completion. Both the experimental and conventional practice time will be exactly thirty minutes so each methodology receives equal amount of treatment time.

Experimental Factors

The experimental factor in the study is the use of computer software to provide spelling practice. The software is instructional computing courseware for the Apple IIe computer called "Spellevator" and "Spelling Workout" developed and produced by (MECC) Minnesota Educational Computing Corporation. The "Spelling Workout"

software will lead subjects through a three-step spelling process. The subjects will take a pretest, practice words they missed, and then take a posttest. The "Spellevator" program seeks to motivate the subjects to practice their classroom spelling words by utilizing the computer's capabilities in an arcade-style game. The four weeks the subjects are receiving the computer method for classroom drill and practice, both spelling programs will be used. The subjects will receive thirty minutes of practice time each school day, which is exactly the same amount of time given for the conventional practice. The computer lessons will be list 4, 6, 8, and 10. Some of the same phonetic sounds will be studied, but the list of words using these phonetic sounds is different from the paper and pencil methodology.

Since many elementary schools, both Christian and public, are still using the Apple IIe technology and many have access to programs developed by MECC, it is hoped that this study will provide information that will be both useful and valuable for continued computer usage in all such classrooms. Technology has become part of our society, and children need to be exposed to software that will not only help them become computer literate, but will also help them to learn and think. "Inexpensive spelling computers can give children entertaining practice, but students still need teachers who look for patterns in a child's spelling errors and teach accordingly" (Nolen p. 538). This study does not compare computer-assisted instruction to teacher instruction. It merely compares computer drill to paper and pencil drill. If there is a difference in methodology it would behoove teachers to use the methodology that will best help the students learn to spell.

Chapter 4

RESULTS

Results of the Data

From the figures in Table 1, one can see that the null hypothesis was retained. There is no significant difference between traditional methods of drill and practice and the computer method of drill. The students working on computer were as successful in learning their spelling words as those using traditional methods. The mean score for the paper and pencil method was 24.86. The mean score for the computer method was 25.78. On the average the students learned one more word with the computer method than the paper and pencil method. This slight increase was not statistically significant.

Table 1

A Comparison of Spelling Posttest Scores

Groups	N	Mean	Mean Difference	Std. Error Difference	t-ratio	Sig. 2-tailed
Paper/pencil	36	24.86	-.92	.77	-1.194	.236
Computer	36	25.78				

All students did learn most all of their spelling words with either method. The mean scores are very high for both methods. The mean for the Paper and Pencil method is 89% of the spelling words given. The mean for the Computer group is 92% of the spelling words given. All students made progress regardless of the methodology used for drill and practice.

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Sometimes teachers are more concerned with individuals than statistical procedures for whole groups of students. Only nine subjects were represented in this study. Of the nine subjects, during the eight weeks of the study, six of them scored an increase of five additional words using the computer method over the paper and pencil method. One subject only scored one word better. Of the two subjects that scored slightly lower using the computer, these represented the best spellers in the class. Their lowest scores were 94%.

Chapter 5

SUMMARY, CONCLUSION, OBSERVATION, RECOMMENDATIONS

Summary

During the 1999-2000 school year a study was conducted to determine the effect of drill and practice on a microcomputer and mastery of spelling words. The study was conducted in the third grade of a Christian school. The subjects were the entire class. The students received drill and practice using traditional methods one week and computer drill and practice the next. The drill and practice time was thirty minutes a day for each method.

The A Beka curriculum was the spelling curriculum currently in use by the school. The researcher was the teacher of the class. All the students received instruction each week. The only difference was the method of drill and practice. The computer drill utilized the "Spellevator" and "Spelling Workout" game produced initially by MECC (Minnesota Education Computing Corporation) and now available from the Learning Company. The program is available to both Windows and Macintosh and is now called "Spellevator Plus." The program now available is virtually the same as the Apple IIe except that the graphics are updated and better looking. The way the child earns points and enters answers is the same. Both versions of the game also reinforce the meaning of the spelling words and use their words in sentences. The researcher thought that this

usage would help students remember and use correct spelling whenever these words were given.

Observation

During the 8 weeks of the study in which the students participated, the researcher received many positive reports from the students about time spent on the computer. Most of the students preferred computer drill over paper and pencil activities. One student who had minimal success in the game wanted to spend computer time with a different program. This student still preferred computer time to paper and pencil activities. It would be good if a variety of computer games could be played with the same spelling words entered into the computer just once. The researcher had four Apple IIe computers and one Pentium. The newer Pentium had the same game format as the Apple IIe computers. The researcher had to enter the spelling list and definitions to each kind of computer, but the format for the drill and practice was almost exactly the same. The Pentium did allow for a Pretest and a Posttest on the computer and allowed that data to be printed in a variety of forms.

The software written over a decade ago is virtually the same today. The graphics were improved on the Pentium, but many of the students preferred the Apple IIe because of the "Tower of Great Performers" feature not available on the new version. This feature listed the last ten students with the highest scores. The students wanted to earn enough points to get their name on the list in the "Tower of Great Performers." The computer game only accepted correctly spelled words. The students received immediate feedback on whether or not their answers were correct. Paper and pencil drill required a

teacher to spend time grading the written work. The student often did not find out that their spelling of a word was incorrect until the next day when the teacher returned their written work.

Conclusion

The null hypothesis was supported, and there was no significant difference between methods of traditional drill and computer drill. The students, if given a choice however, would prefer to work at the computers. The researcher asked the students to vote on which method they liked the most, and it was unanimous for the computer. The computer program required the teacher to enter the spelling words, the definition, and three incorrect choices. This data entry could take as much time as an hour and a half for the teacher to complete. Perhaps making learning more fun is motivation enough for teachers to spend the time entering the data into the computer. Once the data are entered, the teacher can use this data for as long as that curriculum is in use. The teacher would have less time invested over a five-year period especially since the computer eliminates the grading of drill work.

Recommendations

Since there was no significant difference between the methods of drill, I recommend that students be given a choice about the kind of practice they want to do. Students have a variety of learning styles and learning preferences. A wise teacher will make the learning as enjoyable as possible for all students. Many things require practice to become proficient. Spelling words correctly is a skill necessary for all written work. Students should be encouraged to do their very best to make as few spelling errors as

possible. In addition, all the spelling lists could be entered at one time. This would allow students to progress at their own speed. The CD ROM version of the game track student progress for the teacher, and this would allow for more individualization.

More research needs to be done on CAI not just in spelling, but with all available educational software. I have discovered that while computer hardware has drastically improved, software development is lagging behind by at least a decade or more. "Spellevator" was and still is a good program, but computer hardware has advanced so much in the last decade that the software should be taking advantage of its greater capabilities, not just in graphics and tracking, but in design as well. Perhaps research into the variety of learning styles could be included in the designs of computer assisted instruction. Multimedia presentation tools claim to do just that, but other areas of CAI such as the drill and practice and the tutorial modes could also benefit from further research.

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